

IMPLEMENTING TWI

**Creating and
Managing a Skills-
Based Culture**

**Patrick Graupp
Robert J. Wrona**



CRC Press
Taylor & Francis Group

A PRODUCTIVITY PRESS BOOK

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Boca Raton London New York

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CRC Press
Taylor & Francis Group
6000 Broken Sound Parkway NW, Suite 300
Boca Raton, FL 33487-2742

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Version Date: 20160418

International Standard Book Number-13: 978-1-4398-2597-6 (eBook - PDF)

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Dedication

To our wives Arden Graupp and Inez Wrona

Without their patience, encouragement, and support
we would not have been able to maintain our focus on
bringing TWI back into the mainstream of training.

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Foreword

Companies are under ever increasing pressure to remain on the competitive cutting edge. A fully engaged workforce is essential for doing this successfully, and Training Within Industry (TWI) is a powerful approach to creating and maintaining this engagement.

The increasing competitive pressure comes from a variety of forces.

- Economic development in Asia, South America, and Eastern Europe has increased the number of potential rivals challenging for customers loyalties.
- Incredible improvements in communication and transportation have converted those potential rivals in actual ones.
- Scientific and technological advances compress the half-life on any market offering's viability, increasing the demand for ever faster improvement and innovation in development, design, production, and delivery.

These three forces are significant under any circumstances. Add to this the fallout of the world wide economic recession the last few years. All organizations have to rapidly reconfigure how they bring value to market as customers have become more circumspect in terms of how they are going to satisfy needs that have changed in significant, discontinuous ways.

That workforce engagement is essential is also without question. A naive view might be that increased technological sophistication has increased the capacity for a select brain trust to do the hard 'thinking' of

what to sell and how to make it, leaving the remainder of the organization to do nothing more than be button pushing monkeys for automated equipment and processes.

This belief that mind and muscle are separable is simply wrong, at least as wrong now as it was in the past. In the heyday of scientific management, it was thought that a select few could do the time motion studies to reveal how the remaining masses could work most effectively and efficiently. This missed incorporating in work design the subtleties of circumstances known only by those involved in actually doing work, and it missed incorporating the additional critical perspective other people might have brought to the design. Separating mind from muscle had no basis other than the elitist social construct of the day.

The need for broad engagement has only gone up, not down. Walk into any work environment—manufacturing, healthcare, and any service sector—and the number of distinct professions needed to accomplish work has gone up by many multiples and the sophistication of the equipment people use to complete their work has increased exponentially as well. Creating value is ever more a team effort, with the skills required of individual team members ever more challenging in their acquisition and demanding in their expression. Manufacturing is no longer the physically hard work of wrench turning—like Charlie Chaplin in *Modern Times* or a character in Diego Rivera's fresco, *Detroit Industry*. It is cutting edge physics, chemistry, and increasingly biology brought to bear in creating products useful to society. The amount of required know how is considerable.

Which brings us to training. Success depends on staying ahead of the curve, and staying ahead of the curve depends on engaging the minds and the muscle of everyone in the organization. How then, to get that engagement? It is unrealistic to expect that people will arrive with the skills already intact. Even were they products of the most successful education, and we know not all education is so successful, they'll lack the job-specific skills and knowledge to succeed. People could acquire skills

through experience alone, but that is both time consuming and unreliable. How do you ensure people get the right experiences at the right time? Or, people could be developed in a mentored apprenticeship fashion. But that too takes considerable time and produces uneven results.

Therefore, an essential ingredient in being competitive is having a reliable system for developing skills. This is where Training Within Industry comes in: Job Instruction training to bring novices up to speed, Job Methods training so they can be active agents in improving what they did and how they did it, and Job Relations training that teaches the foundations of positive employee relations.

Graupp and Wrona bring many examples of companies that embraced these elements of TWI, improving their competitiveness by improving their capacity to fully engage their workforce productively. These examples can serve as inspiration and models for years.

With best wishes for continued success,

Steven Spear

Sr. Lecturer, MIT Sloan School of Management

*Author, *The High Velocity Edge—How Market Leaders
Leverage Operational Excellence to Beat the Competition.**

Acknowledgments

Our objective for writing *The TWI Workbook* published in 2006 was to document the standardized “J” program methodology that, when delivered by properly trained trainers would enable organizations to attain the desired results from this training. In that book we acknowledged “all the people too numerous to mention who brought us into their plants and firms across the country (*and now the world*) to introduce their people to TWI.” Although we find ourselves in a similar situation with this follow-on book, here we would like to personally recognize all the people that work for the companies that contributed to the case studies in this book and give credit where credit is due.

However, there is also group of people at these companies that contributed a significant amount of personal effort to make sure their story was accurately documented on behalf of their organization. We are indebted to Martha Purrier and Linda Hebish at the Virginia Mason Medical Center, Suzanne Smith at W. L. Gore, and Sam Wagner at Donnelly Custom Manufacturing for the enthusiasm they brought to this challenge. A special thank you to Mark Bechteler and Dean Burrows at Nixon Gear; Scott Curtis, Scott Laundry, Jamie Smith, and Jennifer Pickert at the Albany International Monofilament Plant, and Alan Gross, Dustin Dreese, and Jennifer Dietter at Currier Plastics. These people not only took time from their busy schedules to work with us on their case study, they also opened their doors for hundreds of visitors from around the world to tour their plants in the Syracuse, NY area where they learned firsthand from those involved about the level of commitment

it takes to reap the benefits of TWI, and the on-going effort needed to continue down this path.

We are very fortunate to be working with talented and dedicated TWI Institute Master Trainers, Richard Abercrombie and Mike Braml, who spend weeks away from home traveling across the US and around the world to introduce TWI and to train trainers for organizations to internalize the training. These professionals are always prepared to introduce companies to the “J” programs and to coach them on how to get started down the right path. Their job was made that much easier thanks to Lynne Harding who provides logistical support for the TWI Institute.

Our ability to write about implementing TWI at the level of detail found in the case studies in this book would not have been possible had it not been for a select group of distinguished authors that publicized the relationship TWI has with the Toyota Production System and Lean. We thank Robert “Doc” Hall, Jim Huntzinger, Jeffrey Liker, David Meier, Alan Robinson, Dean Schroeder, John Shook, and Art Smalley who opened the doors for the resurgence of TWI.

Introduction: A Compelling Need for Skills Training

For a variety of reasons and across all facets of the workplace landscape, organizations are finding more and more that they can't find people who possess the skills they need to get the work done. According to the *2005 Skills Gap Report*, a survey of 8,000 NAM members conducted by the National Association of Manufacturers (NAM), the Manufacturing Institute's Center for Workforce Success, and Deloitte Consulting LLC, there is a critical shortage of skilled workers in both breadth and depth. The report projected that this shortage would hinder the ability of U.S. manufacturers to compete in a global economy. That time has certainly arrived. Therefore, we can no longer wait to take action with the tools we have, and one of these is Training Within Industry (TWI) that was created for just such a need. Three events are coming together to accelerate the skills shortage at an inopportune time for manufacturers already struggling with how to compete in a global economy.*

An Aging Workforce

Projected demographics for 2010 showed that the workforce in the age range of 45 to 54 will grow by 21%, as the baby boomer generation

* Terry Wiseman, *A Perfect Storm Hits the Skilled Workforce*, Plant Engineering, December 2008.

workforce (age range of 55 to 64) grows by 54%. This raises the question of how companies will find qualified replacements as the boomers retire from the workplace.

A Compromised Educational System

Up to 50% of current students drop out of school in a majority of school districts, and only one-third of all graduating U.S. students can perform at the twelfth-grade level. That is not a good indicator of the quality of the workforce that will be available to manufacturers in the future as the skill level requirements for production workers continue to increase. This situation makes it that much more important for companies to capture their “tribal knowledge,” the tricks and knacks that people develop on their own over years of experience on the job. This is the type of critical information and acquired knowledge that these people will take with them unless it can be quickly passed on to new employees. Otherwise, new employees will have to learn it by repeating the same mistakes their predecessors did when they learned these jobs.

Lack of Technical Apprenticeships

Companies do not support apprenticeship programs as they did in the past. Even when they do, individuals are not signing up due in good part to the fact that parents and high school guidance counselors do not understand the opportunities that exist for skilled people in industry today. To this list of requirements we add *Lean Manufacturing* that is placing higher demands on production workers, teams, and their leaders. In today’s workplace, these people are increasingly being asked to run more sophisticated machinery and to make daily decisions that have a direct effect on the profitability of their organizations.

2005 Skills Gap Report—The American Manufacturing Workforce

According to the NAM survey, the shortage of qualified employees exists in the following critical areas:*

- Eighty percent of manufacturers surveyed are experiencing an overall shortage of qualified workers that cuts across industry sectors.
- The shortage of qualified workers is most acute on the front line, where 90% report a moderate to severe shortage of *qualified skilled production employees*, including machinists, operators, craft workers, and technicians.
- Manufacturers face the additional challenge of poor skill levels among current employees, with 46% reporting inadequate problem-solving skills among employees.

The magnitude of these shortages is better understood when we look at how high the bar was set by the creators of this survey. The following definition of a *qualified skilled production employee* was provided as a reference for companies to respond to the survey questions.

A skilled production employee is defined as being able to operate manufacturing equipment in more than one process; capable of recognizing process improvement opportunities; and have knowledge of manufacturing equipment and processes sufficient to understand and resolve moderately complex production issues, provide preventive maintenance, and make routine repairs. The skilled production worker can also apply advanced problem solving and analytical thinking skills to troubleshoot non-routine production issues.

* 2005 Skills Gap Report—A Survey of the American Manufacturing Workforce, NAM, Washington, DC, 2005.

If the above definition accurately describes your skilled production people, then one must ask how many of these people are over 55, how many of these people will go into retirement in the next few years, and how will you replace these people when they do retire?

The Shrinking U.S. Workforce

A majority of the more than eight hundred companies that participated in the NAM survey were small to midsize companies with fewer than five hundred employees. However, similar data were published in 2005 from a study of the strategies related to an aging workforce at three major multinational companies. These companies shared the same challenges of a shrinking workforce as the small and midsize manufacturing companies that made up the bulk of the NAM report companies.*

The immediacy of the challenge can be seen in the following projections for the year 2010:

- The overall rate of U.S. workforce growth was 30% in the 1970s and 12% in the 1990s through 2005, and is projected to no longer grow beginning in 2010.
- The number of U.S. workers forty-five to fifty-four will grow by 21% as the number of fifty-five- to sixty-four-year-olds grows by 52%.
- The number of U.S. workers thirty-five to forty-four years old will decline by 19%, while this pool of workers is also expected to shrink by 19% in the United Kingdom, 27% in Germany, and 9% in Italy.

Our shrinking workforce is also impacting healthcare, energy, and the public sector, where efforts are already being made to do more with less in order to overcome shortages of qualified people. The problem

* Lorrie Foster, Confronting the Global Brain Drain, *Knowledge Management Review*, November/December 2005.

has a far-reaching effect. “The U.S. Government is expecting to also feel the crunch: Within five years, half of the federal Chilean workforce (U.S. citizens working in Chile) will be eligible to retire by 2010.”* As priorities shift to staff retention and transferring knowledge, the need for better skills in how to lead and to train people is that much more critical than it was in the past.

In the healthcare industry, where costs appear to be out of control, nurses have long been in short supply, as are technicians and associated hospital staff. According to a 2002 report by the American Hospital Association, the nursing shortage “reflects fundamental changes in population demographics, career expectations, work attitudes and worker dissatisfaction.”† According to this research, hospital nursing vacancies will reach eight hundred thousand, or 29%, by 2020. The number of nurses is expected to grow by only 6%, while demand for nursing care increases by 40%.

Once again, we run into the issue of a shrinking workforce. Women ages 35 to 49 constitute the largest number of RNs in the workforce, while RNs under the age of 35 constitute the smallest. One way to reduce this demand for nurses from a smaller workforce might be to train other staff members on how to perform administrative and other tasks that can be passed down to others so that nurses can devote more of their time to the patient care for which they are trained.

Impact of a Shrinking Workforce on Manufacturing

The results of this survey indicate that global competition will force U.S. manufacturers, in order to stay in business, to compete less on cost than on productivity, flexibility, quality, and responsiveness to customer needs. This shift in thinking is already pushing manufacturers

* Ibid.

† M. W. Stanton and M. K. Rutherford, *Hospital Nurse Staffing and Quality of Care*, Agency for Healthcare and Quality, Rockville, MD, 2004.

and other industries to put a premium on the skills, morale, and well-being of their people. Companies that do not treat people as their most important asset are running the risk of losing their best people to other companies that will be willing to pay a premium for highly qualified employees who possess skills that are in short supply.

In 2008, the first members of the baby boomer generation turned 62, the average age of retirement in North America, Europe, and Asia, where 80% of workplace growth will occur among people 50 years or older over the next fifteen years. It is projected that by 2050, 40% of Europe's population and 60% of its working age population will be people over 60, at which time Germany, Italy, Spain, and Japan could face economic crisis from having mounting pension obligations funded by shrinking workforces in these countries.*

These projections do not reflect the impact of all the forced retirements that resulted from the economic crisis caused by the financial industry meltdown of 2009, which is making a bad situation even worse. One can't predict the impact of the skills drain going on in the automobile industry caused by the early retirement of so many people, many of whom were not physically, mentally, or financially prepared to exit the workforce.

As the competition increases for a shrinking number of skilled people, organizations must also rethink the ways they manage, train, and treat their key people, especially their supervisory group. When layoffs and reduced hiring are the order of the day, these are the people companies must invest in to keep pace with the demands of the times, just like the properly trained supervisors who are credited for the successful expansion of U.S. industry during World War II.†

* It's 2008: Do You Know Where Your Talent Is? Why Acquisitions and Retention Strategies Don't Work, A Deloitte Research Study, New York, 2004.

† Alan G. Robinson and Dean M. Schroeder, Training, Continuous Improvement, and Human Relations: The U.S. TWI Programs and the Japanese Management Style, *California Management Review*, Volume 35.

The Disengaged Employee

According to Deloitte Research, downsizing, increased employer demands, job disenchantment, and technologies that keep people plugged into their jobs without human interaction have taken their toll. The only thing worse for employers than a shortage of skilled people is to have employees who would rather not be working for the company but make no effort to leave.

According to current surveys, more than half the workforce is fed up:

Pollster Gallup has found that 80 percent of British workers lack commitment to their jobs, with a quarter of those being “actively disengaged” from their workplaces. The situation is worse in France, where only 12 percent of workers in France were engaged in their work. In Singapore, 17 percent of work force is actively disengaged, creating a corrosive force in organizations. Disenchanted workers pull down productivity, increase churn, and darken the morale of the people around them. The annual economic costs are huge: as much as 100 billion Euros in France, US\$64 billion in the UK, US\$6 billion in Singapore, and a whopping \$350 billion in the U.S.*

The crucial source of this disengagement and the number one reason why people leave a job is the poor relationship they have with their boss. This situation is typically overlooked and leads to myriad troubles in the workplace. More than half the workforce in the U.S. was already fed up with their work as the country entered these tough economic times when jobs became scarce and turnover was no longer a true measure of employee commitment. With improvements in the economy underway, companies might increasingly be surprised to hear from employees what they have not heard in a while: “I quit.”†

* It's 2008: Do You Know Where Your Talent Is? Why Acquisitions and Retention Strategies Don't Work, A Deloitte Research Study, New York, 2004, page 4.

† Joe Light, More Workers Start to Quit, *Wall Street Journal*, May 25, 2010, page D6.

Recruiters and human resource experts say the increase in employees giving notice is a product of two forces. First, the natural turnover of employees leaving to advance their careers didn't occur during the recession because jobs were scarce. Another factor making it harder for companies to retain employees is the effect of the heavy cost-cutting and downsizing during the downturn on workers' morale. A survey conducted last summer for the Conference Board, a management research organization, found that the drivers of the drop in job fulfillment included less satisfaction with wages and less interest in work. "Employees feel disengaged with their jobs, which is going to lead to a lot of churn as we come out of the recession," says Brett Good, a district president of Southern California for Robert Hall International, an executive recruiting firm.*

Companies would do well to make it a priority to properly train the people tasked with leading others if they expect to turn around their disenchanted employees. The best way to energize people is to provide them with the tools they need to get their jobs done in the most effective way. For the most part, people want to be proud of their work, and they want to be rewarded for the good job they do. The best way to channel that energy into positive workplace relationships is to provide supervisors with the skills they need to lead people just like TWI did during WWII, like Toyota has done since adopting TWI in 1951, and as you will learn from the case studies in this book.

Building Talent: The New Old Mindset

Redesigning jobs, improving working conditions, and ensuring that key people are properly trained and deployed go a long way in keeping people engaged. The most successful companies doing this are those that

* Ibid.

encourage their people to participate in improvement activities without the fear of losing their jobs as a result. Deloitte Research concluded that a different approach to training people was needed to both properly train them and to keep them engaged.* As you will see below, the three suggestions from Deloitte on how to better train had already been captured more than sixty years ago when the TWI program was created.

1. *Rather than push more information onto employees through conventional training, it is more important that they “learn how to learn.”*

Job Instruction training (JI) teaches supervisors how to quickly train employees to do a job correctly, safely, and conscientiously. The method emphasizes preparing the operator to learn by first finding out what they already know about the job and fitting the instruction into this existing mental framework. By also giving the reasons why the job is done a certain way, people can understand the importance of the technique and the negative ramification if done incorrectly. In these ways, the learner is engaged in the process of learning instead of just being told or shown how to do a job.

2. *The best way to develop critical talent is through the collaborative resolution of real-life issues (‘action learning’).*

Job Methods Improvement (JM) is unique in its simplicity allowing supervisors and individuals to improve the way they do their jobs. The aim of the JM program is to help produce greater quantities of quality products in less time by making the best use of the manpower, machines, and materials now available. In using the JM method, supervisors are taught to work with others, especially operators, in coming up with new methods and to take on improvement opportunities in their immediate area of responsibility, ones that they can do something about.

* It's 2008: Do You Know Where Your Talent Is? Why Acquisitions and Retention Strategies Don't Work, A Deloitte Research Study, New York, 2004, pages 6 and 7.

3. *They learn not by pondering a hypothetical problem, but by directly tackling real issues.*

In all of the TWI training modules, each participant learns by applying the method to an actual job from their own areas—the “learn by doing” approach. This is also true with Job Relations training (JR) which teaches supervisors how to build positive employee relations, increase cooperation and motivation, and effectively resolve conflicts. By bringing in actual “people problems” to class that require them to take action, supervisors learn to handle problems by gathering and weighing facts before taking action, and then to check results to evaluate whether the action taken has helped production. In each real life problem discussed in the class, trainees also consider how that problem could have been prevented.

Lean Manufacturing in the Western World: Underutilized People

The Toyota Production System focuses on the seven wastes of production (defects, overproduction, inventory, motion, processing, transportation, and waiting), to which *underutilized people* was added in the Lean production version of TPS when introduced in the Western world. As David Magee points out in his book, *How Toyota Became #1*:

The secret to Toyota’s success is ... how it approaches its business as a whole, with an underlying focus on “respect for people.” By maintaining a focus on one very lofty ideal, and by implementing and maintaining a business structure that encourages every employee to be actively engaged in pursuing the company’s goals, Toyota is developing into a self-generating internally combusive enterprise.*

* David Magee, *How Toyota Became #1*, The Penguin Group, New York, 2007, p. 8.

This is what makes Toyota's model as applicable to a bank, a retailer, or a hospital as it is to a manufacturer. Regardless of the business you are in, workers in today's high-paced technological world simply must "bring their minds to work." They cannot check their brains at the door like in the past era of mass production, where long tedious production runs, changeover specialists, quality by inspection, etc., allowed them to mindlessly do their work, and get paid well for it. The old model in which the blue-collar workers were the muscle of the organization and the white-collar workers were the brains was shattered by the Lean reformation that took place in Japan after WWII and today's management is providing Lean training to give people the tools they need to function in the new model. In turn, Lean has also dramatically changed the roles of the supervisor who must replace his or her firefighting skills with leadership skills in order to solve problems and prevent fires from getting started in the first place.

Saving the Supervisor

To make the worker responsible for his job and for that of the work group is also the best—and maybe the only—way to restore the supervisor to health and function.

Peter F. Drucker, *Management*, 1973

"For a half century or more the first-line supervisor, especially in manufacturing and clerical work, has seen his role shrinking in status, in importance and in esteem. Where a supervisor was 'management' to the employees only a half-century ago, he now has, by and large, become a buffer between management, union, and workers. And like all buffers, his main function is to take blows."* Bob remembers well what

* Peter F. Drucker, *Management: Tasks, Responsibilities, Practices*, Harper & Row, Publishers, 1973, pages 279, 280.

it was like being a buffer between management and the union when he was a shop floor supervisor at the Chevrolet-Tonawanda General Motors plant in the late 1960s. He did not appreciate the value of that learning experience until, as an independent TQM manufacturing consultant, he learned that supervisors were no better trained for the job than he was twenty years earlier.

Supervisors throughout the world today are still separated from the people they supervise by a wall of resentment and suspicion that comes from their role as a “buffer” between management, union, and disengaged workers. The supervisor’s role as a “firefighter” has not diminished with the introduction of Lean Manufacturing because management continues to pressure managers and supervisors to do more with less by instilling more discipline. Increased discipline may in fact be needed, but as Mike Rother cautions in his book *TOYOTA KATA*, greater emphasis should be placed on how people can sense and understand a situation so they can react to it on their own in a way that moves the organization forward.

“The thinking (of management) seems to be that if people in the organization would adhere more closely to their work standards and do what they were supposed to do, there would be fewer problems. Unfortunately it does not work this way. Keep in mind the second law of thermodynamics, or entropy, which states that even if we follow the work standard, a work process will tend to slip toward chaos if we leave it alone. No matter what, there will be problems that the operators, if left alone, will have to work around. The process will decay.”*

The Role of Leaders at Toyota

In his book, Rother explains how Toyota manages from day-to-day embedding continuous improvement and adaptation into and across the organization. This is accomplished through the use of two *kata* (the

* *TOYOTA KATA: Managing People for Improvement, Adaptiveness, and Superior Results*, McGraw-Hill, 2010, pages 163 and 164.

Japanese word for behavior routines, habits, or patterns of thinking and conducting oneself) that are taught to all Toyota employees:

The Improvement Kata—a repeating routine of establishing challenging target conditions, working step-by-step through obstacles, and always learning from the problems we encounter; and

The Coaching Kata—a pattern of teaching the improvement *kata* to employees at every level to ensure that it motivates their ways of thinking and acting.

Although these behavior patterns are not visible, they are “a big part of what propels that company as an adaptive and continuously improving organization.”*

“The primary task of Toyota’s managers and leaders then does not revolve around improvement per se, but around increasing the improvement capability of people. That capability is what, in Toyota’s view, strengthens the company. Toyota’s managers and leaders develop people who in turn improve processes through the improvement *kata*. Developing the improvement capability of people at Toyota is not relegated to the human resources or training and development departments. It is part of every day’s work in every area, and it is managers and supervisors who are expected to teach their people the improvement *kata*...part of how people are managed day to day.”†

This brings us back to Peter Drucker who in 1973 wrote: “No organization can function well if its supervisory force does not function.”

The crisis of the supervisor would by itself be reason enough to think seriously about organization of the worker and working. For making the worker achieving, making him or her responsible, is the one way of making the supervisor effective as a resource for the worker and

* TOYOTA KATA: *Managing People for Improvement, Adaptiveness, and Superior Results*, McGraw-Hill, 2010, page xvi.

† Ibid, page 186.

the work group. Only by becoming a resource for knowledge, information, training, teaching standard setting, and guiding the achieving worker and his work group does the supervisor move away from the current untenable role of “supervising” people.*

Restoring the Supervisor to Health and Function

We have learned much from the history of TWI in the U.S. during World War II and from the Japanese experience with TWI after the war, when Japanese industry was running at less than 10 percent of its 1935 to 1937 levels. It was during this period of reconstruction that the three standardized TWI training programs for supervisors were adopted on a national level. Job Instruction training (JI) taught supervisors the importance of proper training and how to provide this training to their workforce. Job Methods training (JM) taught supervisors how to make the best use of the people, machines, and materials now available. Job Relations training (JR) taught supervisors how to get results through people by treating them as individuals.

The case studies in this book demonstrate how managers, supervisors, and team leaders benefit from the TWI training that provides the skills they need to become a resource for the worker and their work group. It is only when the worker and their work group accept responsibility for their work that the primary responsibility of the supervisor can be to create and maintain a good working environment by dealing with the day-to-day abnormalities in the worksite.

Our desire in writing this book is to help you understand how TWI can help you solve the compelling need for skills training for your people in the workplace. Throughout, we will show how companies have implemented TWI, following the same prescribed formulas so

* Peter F. Drucker, *Management: Tasks, Responsibilities, Practices*, Harper & Row, Publishers, 1973, pages 280, 281.

successfully used when the program was first developed during WWII, and how organizations are making TWI relevant in overcoming the challenges they face today. We believe that these great endeavors to “learn to do again what we did before” will build a strong foundation for future success at the worker and supervisor levels along the lines of companies in the U.S. during WWII, Toyota soon thereafter, and today the companies who so candidly shared their experiences with TWI in this book.



TWI TAKES HOLD IN THE U.S.—AGAIN

Learning to Do Again What Was Already Done Before

During war time, plants needed to use training in order to supply the needs of the armed forces. Now (with the end of the war), plants must use training if they are going to survive in competitive situations and if they are going to keep on providing jobs and wages for workers.*

—C. R. Dooley, April 1947

Sixty years since the end of World War II, competitive situations around the world have taken their toll on companies that didn't heed this good advice from Dooley, who served as director of the Training Within Industry (TWI) program from 1940 to 1945. The need for good training, as embodied by the TWI programs that were developed to ensure victory in the war was clearly not only a war-time necessity. The global struggle would continue in a different form even after the last shot was fired. These same companies that abandoned the wartime training

* C. R. Dooley, *Report III: Vocational Training, I.L.O. (Montreal, 1946)*, Training Within Industry in the United States, Third Conference of American States Members of the International Labor Organization, Mexico City, April 1946, p. 161.

effort also ignored the early successes of organizations that ventured into Lean manufacturing before and during the 1940s, when wartime production needs forced thinking that was decades ahead of its time. Once the wartime imperative was over, they quickly fell in line with the mass production mindset that took over in the Western world with the end of the war.

In Japan, the story was quite different. The total destruction of the country's industry provided opportunities for the nation to think differently about how to make best use of their limited resources and a generation of workers lost to the war. Whatever their reasons, the Japanese embraced TWI and the program became an integral part of the revival of their production system that would soon become the envy of the entire world. A review of how Lean production evolved provides insight into how TWI became such an important part of that evolution that goes far beyond it being just a training program.

Toyota's Adoption and Dissemination of TWI

Our Lean voyage began like so many others when we read *The Machine That Changed the World*.^{*} Having revisited that book several times since learning the relationship TWI has with Lean production, we gained valuable knowledge from the thoughts of these learned authors on how Lean manufacturing techniques might be diffused around the world:

^{*} James P. Womack, Daniel T. Jones, and Daniel Roos, *The Machine That Changed the World: The Story of Lean Production*, First Harper Perennial, New York, 1991.

We believe we have traveled farther and made more comparisons than anyone else.... So, where do we stand along the path to global diffusion in lean production? And what must happen for the whole world to embrace the system? Remember that as a practical matter there are only two ways for lean producers to diffuse across the world. The Japanese lean producers can spread it by building plants and taking over companies abroad, or the American and European mass-producers can adopt it on their own.*

Toyota has a fifty-year head start quietly diffusing TWI as an integral part of the Toyota Production System (TPS), and needless to say, there is much to learn by retracing the contributions TWI has had on Lean production training. It could be said, perhaps, that TWI came back to the United States when John Shook, author of *Learning to See*, was hired by Toyota and became a TWI instructor at Toyota's then new joint venture with GM in Fremont, California, New United Motor Manufacturing, Inc. (NUMMI), when it opened in 1984. With the completion of Toyota's first ground-up construction of a huge manufacturing complex in Georgetown, Kentucky, the TWI reintroduction continued. "Georgetown began production in 1986, and throughout the 1990s the plant routinely claimed the top spots in the widely watched J. D. Power and Associates quality survey for cars sold in the U.S."† Named North America's second best plant in 2001, second only to Toyota's Lexus plant in Canada, workers in North America were building Toyota cars "faster, better, and cheaper" than the cars coming out of Detroit. We

* Ibid., p. 240.

† Bumpy Road, *Wall Street Journal*, August 4, 2004, p. 1.

now know these North American workers were trained using TWI Job Instruction training.

The authors had an opportunity in 2005 to meet Jim White, who told us his “clock number” at Toyota’s Georgetown plant was 14, which meant he was the fourteenth person hired at the plant. Jim was the training director in the early years of the plant and became a TWI Job Instruction trainer where he instructed the first supervisors of the plant how to teach jobs using TWI. Later, books like *The Toyota Way Fieldbook* and *Toyota Talent* by Jeffrey K. Liker and David Meier, also a former Toyota supervisor at Georgetown, would explain in detail how Toyota used the TWI JI method literally in the same form as they learned it in the 1950s. TWI is a foundational piece in the TPS system, so much so that it was put in place right up front when Toyota started the Georgetown plant.*

Marek Piatkowski was hired by TMMC in 1987 as the training manager for the Cambridge, Ontario, Canada, plant where he delivered the TPS Job Instruction program to train new hires as the plant staffed up for production. These are a few of his initial observations about Toyota’s training style presented in his article “Training Recommendations for Implementing Lean,” posted on the Lean Enterprise Institute website (www.lean.org) in 2008:

Observation 1: One of my first discoveries about training at Toyota was there was very little written about TPS. There were no books or operating manuals. There were some brochures and

* In the current decade, with Toyota’s rapid expansion worldwide, CEO Akio Toyoda stated in response to massive quality recalls in early 2010: “Toyota’s training of workers to maintain quality failed to keep up with the company’s rapid growth” (Nikkei.com, March 17, 2010).

handouts, but nothing close to what we are used to, and there were no written policies defining what TPS was. Toyota was heavily dependent on the spoken word to train and sustain the knowledge of TPS from one generation to another.

Observation 4: Toyota requires five basic levels of knowledge and skills from a leader:

1. Knowledge of roles and responsibilities
2. Knowledge of job elements
3. Training skills
4. Leadership skills
5. Kaizen skills

In a conversation with Piatkowski, he told us that he was not aware in those days that what he had actually been trained to deliver by a senior mentor at Toyota was in fact the TWI JI program. It was not until he read articles on the history of TWI and books were published connecting Toyota to TWI that he learned where the TPS Job Instruction Program actually came from—the TWI JI training that was embraced by Toyota when introduced in Japan in 1951.

A Quick Review of the TWI Program

The TWI Service was one of the first emergency services established by the U.S. Government War Production Board “to help industry to help itself to get out more materials than had ever been thought possible, and at constantly accelerating speed.” The TWI program was developed to assist defense industries to meet their manpower needs by training each worker to make the fullest use of his or her best skill up to the maximum of

individual ability.* Industry responded by having its own people collect, develop, and standardize the TWI techniques as laid out by the TWI Service.

The challenge was to convince top management that standardized programs such as these could help them to meet the unique needs of their business and to neutralize the standard rejoinder that “our business is different.” To achieve this, TWI devised an effective way of explaining the purpose of the J programs. It explained that supervisors have five basic needs:

- Knowledge of the work
- Knowledge of responsibilities
- Skill in instructing
- Skill in improving methods
- Skill in leading

Knowledge of the work meant familiarity with the materials, machines, tools, processes, operations, and technical skills specific to the supervisor’s industry. Knowledge of responsibilities involved an understanding of a company’s specific situation, such as its rules, procedures, safety policies, interdepartmental relationships, and union contracts. TWI did not get involved in either of these two areas because each was unique and different for each company and industry. It did, however, directly address, through the three J courses, the need for skills in instructing, improving methods, and leading.[†]

* War Production Board, Bureau of Training, Training Within Industry Service, *The Training Within Industry Report: 1940–1945*, U.S. Government Printing Office, Washington, DC, 1945, p. 3.

† Alan G. Robinson and Dean M. Schroeder, Training, Continuous Improvement, and Human Relations: The U.S. TWI Programs and the Japanese Management Style, *California Management Review*, 35, 39, 1993.

1. *Job Instruction (JI) Training*. Trains supervisors how to instruct employees so they can quickly remember to do jobs correctly, safely, and conscientiously.
2. *Job Methods (JM) Training*. Trains supervisors how to improve job methods in order to produce greater quantities of quality products in less time by making the best use of the manpower, machines, and materials now available.
3. *Job Relations (JR) Training*. Trains supervisors how to lead people so that problems are prevented and gives them an analytical method to effectively resolve problems that do arise.

TWI trainers then trained people within industry who would, in turn, go on to train other people in industry, creating a multiplier effect that allowed a minimum of qualified trainers to reach a maximum number of people who could then respond to this challenge in the shortest period of time. To measure the impact of the TWI training on the war effort, the TWI Service monitored six hundred of its client companies from 1941 until it ceased operations in 1945. The last survey, performed just after TWI shut down field operations, detailed the following percentages of these firms that reported *at least 25% improvement in each of the following areas*:*

Increased production	86%
Reduced training time	100%
Reduced labor-hours	88%
Reduced scrap	55%
Reduced grievances	100%

* Ibid., p. 44.

Hidden within these percentages are recently acquired production figures that provide insight into claims that TWI shortened WWII by years:

U.S. production totals in 1943 had included 86,000 planes, compared with barely 2,000 in 1939. Also 45,000 tanks, 98,000 bazookas, a million miles of communications wire, 18,000 new ships and craft, 648,000 trucks, nearly 6 million rifles, 26,000 mortars, and 61 million pairs of wool socks. Each day, another 71 million rounds of small-arms ammo spilled from U.S. munitions plants. In 1944 more of almost everything would be made.*

Also hidden in these percentages is what happened at these six hundred companies that were monitored by the TWI Service throughout the war. One of these was the Boeing Aircraft Company, where a program of intense training based on TWI was combined with an internally developed Lean production system to produce the B-17 bomber.

The Boeing Aircraft Company†

The B-17 bomber was already designed and tested before Boeing decided to build the plane at an existing facility south of Seattle that, although vacant and ideally located adjacent to an airport, was only half the size needed to assemble the aircraft with no land available for expansion. Boeing management accepted the challenge to overcome

* Rick Atkinson, *The Day of Battle: The War in Sicily and Italy, 1943–1944*, Henry Holt and Company, New York, 2007, p. 450.

† Bill V. Vogt and Robert “Doc” Hall, What You Can Do When You Have To: Parts I and II, *AME Target Magazine*, 15, no. 1, 1999.

these limitations by committing to having a high-morale, people-dependent system with teams, a strong suggestion system, and a program of intensive training as the foundation to building the most complex four-engine aircraft ever to be mass produced.

How all of the pieces came together is mostly lost to history, but there is enough evidence left of what they did to show how the creativity of people challenged by seemingly insurmountable constraints can rise above these obstacles. Long before anyone ever heard of Lean, the Boeing staff “invented” Lean concepts like flow by developing U-shaped final assembly lines that were fed by subassembly areas in other buildings. A takt time of seven minutes was measured for manual movement from station to station by using a clock they put up on the wall. Material handling was minimized by having subassembly areas feed directly to the line, and the use of dies was maximized by developing quick changeover techniques. The engineers had effectively created a Lean production system that changed the roles of the supervisor years before kaizen had the same impact in Japan.*

With production lines moving faster than at any time in the past, problems had to be solved as soon as they came up on the shop floor in order to keep the lines moving. The pace of production and frequency of engineering changes also required supervisors to be on the shop floor checking and coaching constantly. Since most of the experienced workers were sent off to war, supervisors, who themselves were most likely new at their responsibilities, had to lead a green workforce, making training and

* Masaaki Imai, *Gemba Kaizen*, McGraw-Hill, New York, 1997, Chap. 9.

knowledge of standard work instructions doubly important. Half of the new workforce of thirty-three thousand consisted of cowboys, farmers, fishermen, and lumberjacks. The other half was mostly area housewives.

This compelling need for supervisors to learn these essential skills was filled by TWI.

First, supervisors had to deal with a wide variety of people from different backgrounds who had never worked in a production environment before. TWI taught them to treat people as individuals and to get into problems early and prevent them where possible. The JR course case study of the first woman supervisor was indicative of problems faced at the time. Supervisors were taught on the job by TWI to break down common industrial tasks into easily digested, easily mastered steps for training new people. They also learned to cross-train employees to promote teamwork, and for people to learn how to take on broader responsibility within their work area. What is more, long before the Japanese word *kaizen* would be popularized, workers were trained with TWI to analyze and improve their methods to make them easier and safer to do. One such idea came from a “Rosie the Riveter” woman who, having trouble holding the heavy riveter over the wing she was working on, devised a two-jointed boom that would hold the weight of the machine even as she applied rivets across the entire surface of the wing.

The results of the TWI training, combined with their newfound Lean wisdom, created one of the many miracle stories to come out of the war. The production of B-17 bombers increased from 100 to 364 airplanes per month by March 1944, the peak production period. Production